Assessment of the Impact of Water Quality Variations in the Jordan Valley

Situational Analysis

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FORWARD

Collaborative Approaches for Resolving Water Issues

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Executive Summary

The Jordan Valley Authority (JVA) and the Water Authority of Jordan (WAJ) share the goal of effective water management for Jordan, but they have different visions and separate functions. Water supplies are limited in Jordan, but the demand for high quality water is increasing. Municipal and industrial growth requires that more potable water be diverted from the common supply of fresh water, increasing the discharge of treated wastewater into the irrigation system for reuse. At the same time, irrigation water must meet certain standards to support agricultural development in the Jordan Valley.

JVA and WAJ differ in how they determine water quality and what the impacts are on use. Treated wastewater mixed with floodwater meets standards for unrestricted irrigation according to WAJ, but JVA believes that the treatment plant is overloaded and the resulting irrigation water is polluted, affecting crop production and soils. Because of these differences, JVA rejected a recent water quality study looking at wastewater reuse in the Jordan Valley. Another divisive issue between JVA and WAJ is the cost of moving water between irrigation and municipal uses, since there is a price attached to improving the system of treating and distributing wastewater.

To resolve these issues. JVA and WAJ have formed a Joint Technical Working Group. FORWARD is working closely with the group to collect and analyze data on the impact of irrigation water variations on agricultural crop production and marketing. Additional tasks of the group are to develop recommendations for the government based on the results of the data analysis and to build greater JVA-WAJ coordination for prompt implementation of any recommendations that result.

The results of those deliberations are presented in this situational analysis. The identity and interests of the Jordan Valley farmers, municipal and industrial users, and other stakeholders, along with their positions and the incentives and barriers to agreement, are also discussed.

1. Background and Context of the Problem

Water supplies are scarce in Jordan today and are likely to be much more limited in the future. Mixing fresh water with treated wastewater and other marginal waters to irrigate crops is an attractive means of stretching the existing water supply. However, rapidly expanding populations, particularly within the Amman-Zarqa River basin, are expected to generate much higher demand for potable water to satisfy the thirst of municipal and industrial development. This expansion will in turn cause increased discharge of treated wastewater into the King Talal Reservoir (KTR), thereby raising the percentage of effluent in the water used for irrigation in the middle and southern Jordan Valley.

Complex issues surrounding water in Jordan – its scarcity, delivery, quality, cost allocation, price, and impacts on crop production – are generating increasing pressures on the Jordan Valley Authority (JVA) and the Water Authority of Jordan (WAJ), the two government agencies principally responsible for managing this valuable resource. Identifying and implementing effective policies for handling these issues depend in large part on the existence of a good working relationship between JVA and WAJ.

Irrigation and Water Quality

The main water sources used for irrigated agriculture in the Jordan Valley are:

- King Abdullah Canal (KAC) water, which is a mix from the Yarmouk River, the Tiberias North Conveyor, Mukheibeh wells, and Wadi Al-Arab Dam. This water is considered to be of good quality and is used as is in the northern Jordan Valley.

- King Talal Reservoir water, which is mixed flood water from the Zarqa River and treated wastewater from Amman. KTR water is conveyed to the KAC through the Zarqa River. Irrigation water coming solely from the KTR is applied only in the Zarqa Triangle. Farmers consider this water to be of poor quality.

KTR water is mixed with KAC water to irrigate farms in the middle and south Jordan Valley downstream from the confluence point.

Additional potential sources for irrigation water include the Karameh Dam Project, where the water is anticipated to be of high salinity, and a new storage system on the Jordan River, which is still in the feasibility planning stage.

Principal Institutions in the Water Sector

The principal government institutions involved in managing the water sector are the Ministry of Water and Irrigation (MWI), the Jordan Valley Authority, and the Water Authority of Jordan. The Government of Jordan (GOJ) has provided strong support for

agricultural development in the Jordan Valley since the 1950s through various organizations. As a signal of increasing interest and concern, JVA was established in 1977 to operate an effective irrigation system and provide broad socio-economic support for farmers in the Jordan Rift Valley.

WAJ was established in 1988 to manage the municipal and industrial water supply and wastewater treatment for the Kingdom. It is responsible for bulk water supply, conveyance, treatment, storage, and distribution, as well as wastewater collection, treatment, and return flows. WAJ acquires water for its municipal and industrial uses from various sources, including some facilities shared with JVA. WAJ also supplies JVA with return flows of treated wastewater for irrigation purposes.

JVA and WAJ share the goal of effective water management for Jordan, but they have separate visions and functions. Developments in the late1980s increased the tension between the two authorities. Population growth in Amman required diversion of fresh water from the valley via the Deir Alla Zai project. JVA operates the Deir Alla intake station, where water for Amman is separated from the KAC and pumped to the city. Moreover, expanding urban populations created increased wastewater, which required the construction of new treatment plants in Amman and other highland areas, and contributed more lower quality effluent water to the JVA irrigation system.

JVA and WAJ share the goal of effective water management for Jordan, but they have separate visions and functions.

In 1992, the GOJ established a ministry, MWI, to promote an effective, unified water system for the Kingdom and to encourage coordination between JVA and WAJ. While there has been growing recognition that the goals and functions of the two authorities are interdependent and complementary, good coordination has not yet been fully achieved.

Effect of Treated Wastewater on Irrigation

Treated wastewater discharged into the KTR lowers the water quality in that reservoir. The salinity of the effluent that leaves Amman is much higher than that of the fresh water supplied to the city. In addition to salts, the effluent also introduces certain pathogens and other contaminants that further degrade the water in the reservoir. Water from the KTR is then used for irrigation in the Jordan Valley, either directly or blended with fresh water from the Zarqa River and the KAC. As the percent of wastewater increases in the mix, the quality of water for irrigation is lowered.

Lower quality water for irrigation presents a threat to existing agricultural production and marketing in the Jordan Valley, and to continued effective operation of the JVA irrigation system. Higher salt concentration poses a threat to crop quality and yields, particularly

for crops that are sensitive or moderately sensitive to salinity – crops that currently dominate agricultural production in much of the Jordan Valley. Moreover, other pathogens and contaminants in treated wastewater not only affect the yield, quality, and marketability of the crop, but also restrict the crops that can be successfully grown. They can also potentially affect the maintenance and management of the irrigation system, at both the system level and on the farm, and may affect soil quality in certain locations. Finally, they may pose a threat to human health.

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Farmers in the Jordan Valley have complained that the quality of water delivered to them is not suitable for irrigation. Some farmers sued JVA, demanding compensation. JVA responded by acknowledging water quality variations but alleged that farmers have the legal responsibility to adjust their cropping patterns to the different levels of quality in irrigation water. So far, the farmer lawsuits have been dismissed.

WAJ and JVA Perceptions of Water Quality in the Jordan Valley

JVA recognizes that there are different qualities of water in the valley. It sees KTR as a polluted source. About half of KTR flows are from Es-Samra treatment plant, which is overloaded and unable to discharge wastewater of an acceptable standard for unrestricted irrigation. KTR water not only affects crop production and quality, but also imposes serious restrictions on cropping patterns and profitable markets. For JVA, the impact of KTR water on soils is a continuing concern. KTR salts and other contaminants, including heavy metals, accumulate in the soils and take land out of production. According to JVA, irrigation systems are affected, and farmers incur additional costs because of KTR water.

On the other side, WAJ admits there are potential impacts of different water qualities on crops but claims that water from KTR does meet standards for unrestricted irrigation. WAJ believes that the salinity of KTR causes slight to moderate restrictions depending on on-farm management practices of farmers. WAJ believes that improved on-farm management could increase production and avoid soil salinization. WAJ also sees potential benefits from wastewater reuse. Nutrients, including nitrates and phosphorus, found in treated wastewater benefit the soil. Moreover, WAJ argues that wastewater is a valuable resource to augment the freshwater supplies in the valley.

Previous Efforts to Address the Issue

There have been attempts to assess the impacts of irrigation water quality in the Jordan Valley. They focused on agricultural production and crop quality in relation to water

salinity, but other water quality parameters and their impacts were not examined, including soil salinization, marketing of products, additional maintenance measures, and costs of farmer education programs.

Most recently, a study carried under the Amman-Zarqa Wastewater Master Plan examined the water quality impacts of the Es-Samra treatment plant and KTR water on agricultural production in the valley. The study looked at development areas that are currently irrigated by KTR water and at their cropping patterns. A potential leaching fraction of 30% was used in the economic assessment of crop gross margins. This leaching fraction was not agreed to by all stakeholders. JVA argued that farmer demands could not be met and that there was not enough water for leaching. Other water quality parameters and impacts were not examined in the study. As result, JVA did not accept its findings and conclusions.

Different Prices for Different Water Qualities

JVA is reviewing its current uniform water tariff structure. Officials are considering having future tariff restructuring take into consideration differences in water quality and quantity, and perhaps seasonal variations as well. The data to establish cost-tariff relationships based on these categories are difficult to obtain. In addition, there are costs associated with operating the system at points where water moves between irrigation and municipal uses (for example, the Deir Alla station). Allocation of these costs has never been addressed and remains a significant issue for JVA and WAJ.

There is a price attached to improving the system of treating and distributing wastewater. That price includes the costs associated with:

- Identifying, collecting, and analyzing comprehensive and credible data;
- Providing upgrades in the existing treatment and distribution infrastructure;
- Allocating all costs in a fair manner among different user groups; and
- Educating farmers and others of the need for, and benefits from, new irrigation and tariff systems.

In the context of a tariff that is sensitive to quality differentials, the cross-subsidy among different groups is becoming more important. WAJ and its customers in the Amman-Zarqa Basin might incur some additional costs for subsidizing farmers who receive treated wastewater. Moreover, WAJ customers might also be charged for mitigating the impacts of using this marginal water.

2. MWI Water Strategy and Sectoral Policy

The GOJ has expressed concern over continuing degradation of water quality in the Kingdom and the impact of variations in the quality of water used for irrigation in the Jordan Valley. MWI has recently changed its water policy to state that wastewater treatment should allow for "unrestricted agriculture" and that considerations shall be given to blending treated effluents with fresher water for appropriate reuse. MWI irrigation policy recognizes the impact of marginal water quality and calls for informing farmers of the potential quality of irrigation water so that their choice of crops is made with relevant background information and knowledge. Irrigation policy also states that "differential prices can be applied to irrigation water to account for its quality." Wastewater management policy speaks about crop selection based on irrigation water, soils type and chemistry, and the economics of reuse operations.

Water allocation and reallocation remain a responsibility of MWI, even though it results in shifting water between JVA and WAJ. In recent years, water has been reallocated from agricultural use under JVA to urban uses under WAJ based on social, economic, and environmental considerations. Because tariffs are not based on actual costs, little attention is given to matching the costs of producing water for particular uses to the authority responsible for supplying that use.

3. Identity and Interests of Stakeholders

Three Key Institutions in the Water Sector

Three government institutions – MWI, JVA and WAJ – are the major stakeholders involved in trying to resolve these problems, and each has a different perspective. MWI is responsible for developing national water policy and therefore is interested in defining these problems as a whole, to be dealt with jointly by all interested parties. Proposed solutions to existing problems must have joint JVA-WAJ support, with the objective of optimizing the water resources for the Kingdom as a whole. MWI is also keenly aware of the political implications of discussions and decisions in the area of water policy.

JVA and WAJ also see these problems as being national in scope, but the perspective and priorities of each are defined more closely in terms of their respective mandates, constituencies, and organizational cultures. JVA is the only government authority responsible for irrigation water distribution, development of water resources for agricultural purposes in the valley, and overall socio-economic development in the Jordan Rift Valley. WAJ, on the other hand, is responsible for water resources development generally, protection of water sources, and water distribution in the Kingdom for all uses other than irrigation.

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Their constituencies and tasks, therefore, are largely separate, with JVA looking to farmers and their families in the Jordan Rift Valley, and WAJ, to municipal and industrial consumers in the urban areas. Nevertheless, they also overlap to some extent – in water sources and distribution systems. Both organizations are effective advocates for their respective constituencies, although WAJ appears to be less constituency-driven and more concerned with seeing their work as technically accurate. Employees of the two authorities have established patterns of working with constituents and with each other that are difficult to change.

This division of responsibilities and constituencies between the two authorities creates a natural allocation of most costs associated with securing, distributing, treating, and managing the water. Costs associated with wastewater reuse, however, are not as easily divided between the two authorities, nor are the costs connected with the division of water in the KAC at the Deir Alla station. JVA does not currently charge WAJ for operating the supply of water to the Deir Alla intake, nor does it charge for KAC water to meet municipal raw water quality requirements.

In response to the existing situation, JVA and WAJ selected representatives from their respective organizations to be members of a Joint Water Quality Technical Working

Group. This is the first official instance of the staff of the two authorities working together formally on a technical matter. The Working Group oversees the FORWARD team in designing the study, collecting and analyzing data, and generating recommendations for future action. Initially, the Working Group had two members from JVA and four from WAJ. At the introductory meeting in October, JVA asked for another representative, who was promptly appointed. During its second meeting, the Group unanimously agreed to request the addition of another WAJ member to represent the water quality laboratory. Again upon request of the Working Group, an MWI representative was added in March 1998. Working Group members are:

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- Elham Abu Aisheh, Department of Irrigation, JVA
- Khloud Aqrabawi, Department of Wastewater Treatment , WAJ
- Bilal Bashir, Directorate of Environment and Technology Transfer, JVA
- Ahmed Eliemat, Central Water Quality Laboratory, WAJ
- Mohammed Hisham, Wastewater Reuse Section, WAJ
- Rania Abd Al-Khaliq, Water Resources and Projects, MWI
- Abed Al Wahab Mattar, Wastewater Treatment Plant O&M, WAJ
- Avadies Serpekian, Jordan Rift Valley, JVA
- Mohammed Abu Taha, Zia Water Treatment Plant, WAJ

Other GOJ Institutions

Several other GOJ ministries and agencies, particularly the Ministry of Agriculture, have general concerns that touch on the issues in this situation, but not a major stake at this time. They may become interested stakeholders in the future.

Jordan Valley Farmers

In addition to the three government institutions, there is an occupational group that has a direct stake in an acceptable resolution to this situation – Jordan Valley farmers who use water from the KTR and/or Karameh Dam for irrigation. These farmers rely on this water for their livelihood and pay a tariff for its use; they therefore have a direct interest in its quality, quantity, delivery, and price. They must adapt their cropping patterns to variations in water quality, and they know that their economic return may be affected by the quality variations the system provides. The farmers have a strong

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Jordan Valley farmers are a direct constituency of JVA; they continually interact with JVA personnel. They register requests for water delivery on a twice-weekly basis at the local stage office, and when necessary, ask for an analysis of water, soil and plant samples from laboratory personnel. In addition, farmers often interact with JVA staff in other ways that are linked more to that organization's social, economic, and political mandates. Given this interaction, some JVA staff view their authority as the protector of the farmers' interests within the GOJ.

Farmers in the northern Jordan Valley comprise a different stakeholder group from those in the middle and southern valley because they do not use degraded irrigation water in their farming operations. Northern farmers are interested in maintaining the current tariff level, and because this situation could include a reconsideration of cross-subsidy mechanisms that might lead to a rise in tariff for them, the farmers in the north have a general stake in the issues. Still, their interest is not as direct as that of farmers who are subject to water quality variations as well as possible tariff increases.

Municipal and Industrial Users

Municipal and industrial users are also stakeholders in this situation; indeed, municipal users include farmers as well, who receive their drinking water from the network. The water they receive is fresh, and although they create wastewater as a byproduct, its treatment or further use does not have a direct impact on their lives.

There are linkages, however, which bring an interest and stake. MWI allocations between the agricultural and urban uses affect urban consumers directly. The amount of water available to Amman depends in part on the ability of the agricultural sector to manage its water needs efficiently. The tariffs that urban users pay reflect the balance in costs that now exists between JVA and WAJ. A revision of that balance would surely be passed on in higher tariffs.

Reaction to any tariff increase can generate substantial opposition among urban users, as the experience with the Consumer Protection Society (CPS) suggests. CPS, joined by chambers of industry and commerce, recently organized a campaign against increased municipal water prices and even filed a lawsuit against the GOJ officials for providing water in Western Amman below acceptable standards of quality.

As a more remote linkage, urban users rely on the supply, type, and cost of fruits, vegetables, and other crops from the Jordan Valley that may vary in the future depending on whether or not the system can provide irrigation water of sufficient quality and quantity to farmers.

Other Institutions and Groups

On one level, water in Jordan is a topic of consuming interest to everyone. But such general interest does not make someone a stakeholder in this situation. Nevertheless, many research centers, non-governmental organizations (NGOs – see CPS above as an example), and some groups in the private sector are active on issues relating to the structure of water and wastewater delivery systems. These organizations and groups can be considered secondary stakeholders and may become important to the process in the future.

4. Positions of Stakeholders

GOJ Institutions: MWI, WAJ, and JVA

MWI, WAJ and JVA representatives on the Joint Technical Working Group have not taken rigid positions on the issues. They have all expressed a desire to pull together a well-qualified team of experts as quickly as possible and start collecting and analyzing relevant data. However, each organization approaches the problems with concerns founded upon its different perspective.

JVA representatives are clear about their interest in supporting the needs and concerns of farmers in the Jordan Valley. WAJ members seem less concerned about representing a constituency and more focused on seeing their work as technically accurate. The MWI member reinforces national policy guidelines on the substantive issues, and firmly supports a joint consensus-building approach that urges the two authorities to bridge their differences.

Both JVA and WAJ welcome facilitated meetings with expatriates working alongside local experts. They express a strong interest in better communications and data sharing between the two authorities. They also appear to be committed to working with FORWARD's technical team in gathering and analyzing the data before assessing what it means and adopting recommendations. They recognize the advisory capacity of the group, but stress the need to have frequent and open communication with key decision-makers so that recommendations can be accepted and implemented promptly.

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Jordan Valley Farmers

Farmers in the Jordan Valley have not participated in preparations for conducting this study, and they do not have representatives on the Working Group. Nevertheless, the issues surrounding water quality and irrigation are not new to Jordan Valley farmers, and information is available on farmer interests from several recent technical studies. (See P. Reiss, J. Al-Rashdan, and M. Hanbali*, Opportunities and Options for Participatory Irrigation Management in Central Jordan Valley,* Water Quality Improvement and Conservation Project (WQICP), USAID, January 1995; A. Ghezawi and M. Khasawneh, *Irrigation Water and Agriculture in the Jordan Valley and Southern Ghor: The Possibility of Cultivating Substitute Crops*, Royal Scientific Society, 1993.)

Available information suggests that farmers have confidence in JVA and believe it acts dependably and equitably in its operations. Farmers recognize that an aging irrigation infrastructure creates serious problems for an effective delivery system, and that water quality problems are becoming more acute. There is a serious problem of water theft, which may contribute to the fact that farmers are not particularly concerned with the costs of irrigation water. New JVA regulations encourage farmers to become active in enforcing compliance with JVA delivery requirements on their water line, but Jordan Valley farmers do not have a history of working together. Farmers express a strong belief in their expertise in irrigation management, thus they have little incentive to change their established patterns of water use.

From JVA experience, farmers do not want to pay for costs associated with conveying, treating, or otherwise providing clean water to urban consumers. They want access to irrigation water that will support a profitable cropping pattern. Most are prepared to change current crops to new ones, so long as the new efforts are as convenient as the old, and the product has equal or better marketability.

Finally, there appear to be significant differences in opinions concerning water issues between farmers in the middle and southern valley and those in the north. Farmers in the north have a more moderate climate and higher annual rainfall, and do not have treated wastewater mixed with their irrigation water.

5. Incentives and Barriers to Agreement

A process for reaching agreement should take advantage of the natural incentives that may exist within the context surrounding the situation. It should also blunt, or better yet eliminate, the barriers or disincentives that could block agreement.

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The following perceived incentives support good working relationships and agreement on issues in this situation:

- High priority and visibility of the goal of optimizing water resources for Jordan;
- Timing for JVA – restructuring tariffs is possible given present conditions;
- Timing for the GOJ – relations with the World Bank are improving, and interest in meeting World Bank requests are rising;
- Early appointment of the joint Water Quality Technical Working Group, and its use as a model for increasing JVA-WAJ coordination;
- Cooperative attitude of Working Group members and their enthusiasm for working jointly on this task; and
- A team of outside experts to help the Working Group design tasks, collect data, provide the initial analysis, and facilitate coordination between JVA and WAJ.

Perceived barriers to cooperation and agreement are:

- WAJ and JVA as two separate bureaucracies, with separate constituencies and a history of working independently;
- Technical and financial limits in bringing treated wastewater to higher standards of quality;
- Potentially conflicting demands of constituent groups;
- General inertia that works against an acceptance of change; and
- Political volatility of water issues in Jordan, leaving in question whether the political will exists to restructure water tariffs.

The most valuable forum for overcoming these perceived barriers is the Joint Technical Working Group, one of the principal incentives for reaching agreement. The best tool

would appear to be open, frequent, and clear communication. The FORWARD team can communicate directly and frequently with the Group at all critical stages in the design, collection, and analysis of relevant data. Working through difficult data issues together is an excellent team-building experience, and will serve to encourage a unified team spirit among Working Group members. This effort will also help the FORWARD team collect and analyze data in ways that meet the varied perspectives of different constituencies.

FORWARD can facilitate effective communication between the Joint Technical Working Group and senior decision-makers in WAJ, JVA, and MWI. In that way, interested parties are informed progressively step by step, and the Working Group's final recommendations, when they arrive, are fully understood and accepted by those who make the decisions.

Another important tool to use in overcoming barriers is the credibility and comprehensiveness of the data collected. The more credible and comprehensive, the easier the data can be translated into supporting information for government decision making and constituent acceptance, especially among farmers in the Jordan Valley.

6. FORWARD's Intervention Process

Preparation and Acceptance of the Design

In April 1997, H.E. Koussai Quteishat, then Secretary-General of both MWI and WAJ, proposed an optional activity to USAID and MWI for funding an assessment of the impacts of water quality variations in the Jordan Valley as part of the WAJ-JVA cost/tariff model development program. The activity was proposed as a joint effort of WAJ and JVA that integrated their objectives with a collaborative problem-solving process.

At the design and implementation start-up meeting in mid-August, USAID and MWI concurred with the following objectives of the activity:

- Reach consensus among concerned parties, including MWI, WAJ and JVA, about the nature of water quality differences;
- Determine the impacts of water quality differences on productivity of farms, on-farm management practices, and marketing of agricultural products;
- Reflect water quality differences and their impacts in JVA tariff structure; and
- Contribute to consensus building concerning the reasonable sharing of costs between JVA and WAJ.

The overall objective was the successful adoption of recommendations on water quality and irrigation that reflect current data and responsible analysis. FORWARD's suggested approach to achieving this goal was to focus on reaching consensus on important technical and policy issues related to water quality variations among all parties who need to be "on board" for implementation.

Initial Joint Technical Working Group Meetings

Immediately after the design and implementation meeting, MWI appointed a Joint Water Quality Technical Working Group consisting of four representatives from WAJ and two from JVA. At its initial organizing meeting in October, JVA members requested an additional JVA representative be added to the group, and one was promptly appointed.

A FORWARD facilitator team interviewed members of the Joint Technical Working Group in early December to develop a clear picture of their perceptions of the Scope of Work, their assessment of water pricing and water quality, the role that facilitation can play in the process, and proposed agenda items for the meeting. These interviews,

along with the feedback received during the group's meeting, served as a guide for the activity.

The second meeting of the Joint Technical Working Group on 11 December 1997 brought out issues on which group members agreed, disagreed, or had different perceptions or priorities:

- All members agreed that lower quality water is being delivered to some farmers; that there are differing water qualities in different parts of the Jordan Valley; that an increasing use of wastewater is likely and important for the future; and that salt and dissolved solids are the primary problems with water quality;

- One member believed that accumulation of salts in soils is the real problem, with farmers needing help in managing soil in addition to water; another felt strongly that quality can be adequately handled, but that people disagree about whether the water quality standards are being violated; and a third stated that quantity is an even more important problem than quality; and

- Members believed that they will disagree about many substantive issues, some of the more likely issues being:

    - What constitutes "properly treated?"

    - How does the Ministry translate agricultural considerations into price?

    - Why should farmers pay the costs of the capital investment to move "good" water to industry and Amman?

    - Farmers should only pay the "real" cost of the water.

    - Tariffs should signal and provide an incentive to use wastewater.

Concerning process, all members expressed a desire for these questions to be debated, and the answers determined in the context of overall water management. They saw the need for relevant data to be collected and were ready to proceed as fast as the FORWARD team could be assembled.

Training in Collaborative Problem-Solving

In June 1997, a FORWARD mediation team held an introductory session on collaborative problem solving for senior officials of MWI, WAJ and JVA. Several members of the Joint Technical Working Group participated in the FORWARD mediator's workshop held in October 1997: Bilal Bashir and Avedis Serpekian of JVA; and Ayman Tuffaha of WAJ (Tuffaha moved to the Gulf after December and was

replaced on the Working Group by a colleague). All three attended the December mediator workshop as well. A USAID official, the Jordanian facilitator, and the FORWARD program manager in Jordan also attended the October and December trainings.

FORWARD Technical Team

Jordanian members of the FORWARD team held their first meeting on 1 February 1998. Suggestions were made for needed expertise from expatriate members to provide the proper balance with Jordanian experts. Discussion also focused on the parameters of the study.

By early March 1998, FORWARD had assembled a technical support team consisting of consultants from both Jordan and the US. Team members were selected in full consultation with USAID, MWI, and the members of the Joint Technical Working Group so that they would reflect the needed expertise to achieve the objectives of the activity. FORWARD team members are Farouq Bashabsheh, Raed Daoud, Abdelnabi Fardous, Stephen Grattan, Amer Jabarin, Peter Reiss, Awni Taimeh, and Dennis Westcot.

During the last two weeks in March, the FORWARD team gathered information about the nature of the water conveyance system and water quality problems in the Jordan Valley. The team met together twice to review the scope of work, and its members agreed on the proposed plan for the technical study to present to the Joint Technical Working Group. Stephen Grattan prepared an extended outline of FORWARD's proposed approach and briefed USAID/Amman mission staff.

Joint Technical Working Group Meetings

The following section discusses meetings held by the Joint Technical Working Group. Through these meetings, the group reviewed progress by the FORWARD team and determined the direction for follow-up.

March Working Group Meetings

The Joint Technical Working Group met on 24-25 March 1998. FORWARD presented the proposed plan for the technical study — objectives, goals, and the proposed approach, including assignments for data collection and sources of needed data. The Working Group provided direct input and consensus support for the report, which outlined the potential impact of different water-quality parameters and related issues that affect agricultural production in the Jordan Valley. In the words of a FORWARD consultant, "A positive attitude was developed among those JVA-WAJ Technical committee members that attended the meeting regarding the efforts of the FORWARD technical committee."

The objectives of the assessment had become more detailed:

- Develop consensus among MWI, WAJ, and JVA representatives; USAID staff; and FORWARD consultants on water quality parameters that should be addressed and review the adequacy and acceptability of existing data;

- Determine how water quality varies in different locations over the summer and winter seasons;

- Develop an approach to relate water quality differences to their potential impact on crop yields, changes related to on-farm management, economic returns, marketability, and overall cropping patterns;

- Identify problematic soils and assess how water quality will affect water infiltration;

- Quantitatively and qualitatively relate water quality differences and how they would impact the JVA tariff structure; and

- Develop a consensus that accounts for a reasonable sharing of costs between JVA and WAJ.

The FORWARD team agreed upon an extended agenda of tasks to complete during the following six weeks. Tasks included compiling soil data for patterns of salt distribution and that of other parameters; water quality data for the past seven years; lists of major crops on yearly and seasonal basis for seven years; determining yield potentials for major crops; and agreeing on crop-water-use estimates.

As part of the collaborative process, FORWARD facilitated another meeting of the Joint Technical Working Group on 29 March to discuss the structure of the group and other team-building measures. The objectives of the three-hour session were:

- To agree on the overall role, specific functions, and organizational structure of the Working Group;

- To clarify roles and responsibilities of individual members of the Working Group;

- To develop the Working Group's operating procedures, including meeting schedules, communications, representatives, and working norms;

- To agree on how the Working Group and FORWARD will act as a team; and

- To identify next steps.

Working Group members participated actively in the meeting, developing a joint vision of the group's role, functions, procedures, and interaction with the FORWARD team.

The value of this team-building effort was proven almost immediately as potentially divisive issues concerning what parameters were to be used in the study were addressed without difficulty through collaborative problem-solving measures.

May Working Group Meetings

On 5 May, the FORWARD Jordanian consultants met with Joint Technical Working Group members to provide an update on the progress of data collection and analysis. Attention focused on the fact that the Ministry's crop water requirement data is 50-70% higher than that of the National Center for Agricultural Research and Technology Transfer (NCARTT). A meeting was scheduled for 9 May between Ministry, JVA and FORWARD consultants to identify the reasons for the difference. Working Group members provided important feedback on the importance of pH analysis as a measure for use in on-farm management.

The Jordanian consultants worked with Steve Grattan on 18 May to develop and coordinate the results of water quality impacts on crop yield potential and begin preparation of the technical report. Efforts focused on completing the collection and analysis of data that serves as input for further analysis (for example, water quality data organized by stage office are required to calculate yield potentials for major crops, and yield potentials are needed to prepare the crop budget analysis). FORWARD consultants worked with JVA and MWI on the issue of the accuracy of MWI crop water requirement data and discovered the reasons for differences with NCARTT (overestimation built into MWI data). The consultants also prepared an outline of the technical report.

The FORWARD team met with Joint Technical Working Group members to update them on the progress of the technical study and get their input and agreement on the team's activities so far. FORWARD consultants presented short progress reports and the proposed technical report outline as discussion topics. Grattan pointed out important water quality areas not currently being addressed by existing team members and suggested that another expert be added. In June, Dennis Westcot was added to the FORWARD team as an expert in regulatory, policy, and wastewater reuse issues.

July Working Group Meeting

The US consultants joined Jordanian team members for two weeks in mid-July to review each member's contributions to the report. The full FORWARD team also met with the Joint Technical Working Group. Each consultant provided a short progress report covering the areas in which he had primary responsibility. In addition, the group was able to meet Dennis Westcot for the first time and hear his ideas on wastewater reuse and policy issues.

Most contributions by the consultants were in raw data form in early July, but the FORWARD team was able to complete a major portion of the draft technical report

during the visit by the US experts, which ended 22 July. This initial report included the following list of objectives of the assessment:

- Determine how water quality varies in different locations over the summer and winter seasons;

- Develop and execute an approach that relates water quality differences to their potential impact on crop yields, economic returns, marketability, and overall cropping patterns;

- Qualitatively relate water quality differences and how they would impact on-farm management in different areas within the Jordan Rift Valley; and

- Identify relevant institutional, regulatory, or policy issues associated with irrigation and with treated wastewater.

The report also cites two additional objectives:

- Achieve a consensus on a reasonable sharing of costs between JVA and WAJ, and

- Develop data to help identify a fair tariff structure for water in the Jordan Valley based on differences in water quality and its intended use.

The team submitted a draft report to project management for comment in August. Following this, the draft will go to USAID/Amman staff for their review and comments. A first technical report will be prepared after receiving these comments, and the suggestions and approval of Joint Technical Working Group members.

Based on the technical report, the Joint Technical Working Group will prepare its recommendations to MWI, JVA, and WAJ.